The association of accumulation of stressful life events with depressive symptoms and the moderating role of social support

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Tiivistelmä/Referat – Abstract

Tavoitteet. Aiemmissa tutkimuksissa on havaittu yksittäisten stressaavien elämäntapahtumien olevan yhteydessä voimakkaampaan masennusoireiluun. Poikittaistutkimuksissa on myös havaittu stressaavien elämäntapahtumien korkeamman kumulatiivisen kertymän olevan yhteydessä voimakkaampaan masennusoireiluun. Sosiaalisen tuen vaikutusta tätä yhteyttä muuntavana tekijänä on tutkittu, mutta tulokset ovat olleet ristiriitaisia. Tämän tutkimuksen tavoitteena oli pitkittäisasetelmalla tutkia stressaavien elämäntapahtumien kumulatiivisen kertymän yhteyttä masennusoireiluun sekä selventää sosiaalisen tuen roolia mahdollisena yhteyttä muuntavana tekijänä.

Menetelmät. Tutkimuksen aineisto oli peräisin suomalaisesta Lasten Sepelvaltimotaudin Riskitekijät -pitkittäistutkimuksesta. Otokseen valittiin ne henkilöt (N=753), jotka olivat vastanneet kaikkiin tutkimuksessa tarkasteltaviin kyselyihin. Masennusoireilua arvioitiin osallistujien vuosina 2007 ja 2012 täyttämällä Beckin Depressiokyselyllä (Beck Depression Inventory II; BDI-II). Sosiaalista tukea arvioitiin osallistujien vuonna 2001 tai 2007 täyttämällä Multidimensional Scale of Perceived Social Support (MSPSS) -kyselylomakkeella. Stressaavien elämäntapahtumien määrää arvioitiin osallistujien vuosina 2001 ja 2007 täyttämien kyselylomakkeiden avulla, joissa osallistujat raportoivat olivatko he olleet työttöminä, kokeneet avioeron, oliko heidän puolisonsa tai lapsensa kuollut, tai olivatko he muuttaneet toiselle paikkakunnalle. Stressaavien elämäntapahtumien määrän sekä stressaavien elämäntapahtumien ja sosiaalisen tuen interaktion vaikutuksia masennusoireiluun tutkittiin lineaarisilla regressiomalleilla, joissa kontrolloitiin sukupuoli, ikä, sosioekonominen asema, terveyskäyttäytyminen ja aiempi masennusoireilu.

Tulokset ja johtopäätökset. Stressaavien elämäntapahtumien suurempi määrä oli yhteydessä korkeampaan masennusoireiluun riippumatta sosiaalisen tuen määrästä. Stressaavat elämäntapahtumat eivät kuitenkaan ennustaneet muutosta masennusoireilussa pidemmän ajan kuluessa. Tulosten perusteella ennaltaehkäisevien toimien suuntaaminen useita stressaavia elämäntapahtumia kokeneille henkilöille voisi mahdollisesti vähentää elämäntapahtumien kertymän aiheuttamaa masennusoireilua ja siten myös masennushäiriöitä.

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masennusoireet, stressaavat elämäntapahtumat, akkumulaatio, sosiaalinen tuki

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Tiivistelmä/Referat – Abstract

Objectives. Previous research has found associations between distinct stressful life events and higher depressive symptoms. Cross-sectional studies have also found an association between accumulation of stressful life events and higher depressive symptoms. Results from previous studies exploring the moderating role of social support between stressful life events and depression are mixed. The aim of this study was to explore the relationship between accumulation of stressful life events and depressive symptoms, and the possible role of social support as a moderator, with a longitudinal study design.

Methods. The longitudinal data for the study was drawn from the prospective population-based ongoing research project The Cardiovascular Risk in Young Finns Study. The sample (N=753) included respondents with complete information for all the study measures. Depressive symptoms were assessed with Beck Depression Inventory II (BDI-II) completed by the participants in 2007 and 2012. Social support was assessed with Multidimensional Scale of Perceived Social Support (MSPSS) questionnaire filled in by the participants in 2001 or 2007. Life events were reported by the subjects by self-report questionnaires in 2001 and 2007 by asking if they had experienced unemployment, divorce, death of spouse, death of child or if they had moved residence. The associations between accumulation of stressful life events, depressive symptoms and the interaction of stressful life events and social support were examined with linear regression models controlling for gender, age, socioeconomic status, health behaviors and baseline depressive symptoms.

Results and conclusions. A higher number of overall stressful life events was associated with higher depressive symptoms irrespective of the presence of social support. However, stressful life events did not predict change in depressive symptoms over time. The results of the study implicate that directing prevention efforts to individuals who have experienced several stressful life events could potentially diminish the elevation in depressive symptoms and therefore potentially prevent occurrences of major depression.

Avainsanat – Nyckelord – Keywords
depressive symptoms, stressful life events, accumulation, social support

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CONTENTS

1 INTRODUCTION

Depression is a growing public health concern that affects hundreds of millions of people and is one of the leading causes of disability worldwide (World Health Organization, 2017). Depressive symptoms are even more common; approximately twice as many people suffer from depressive symptoms than clinical depression (Kessler et al., 2014). Experiencing depressive symptoms exposes the individual for a higher risk of developing a major depressive disorder (Cuijpers & Smit, 2004). Therefore, it is important to identify causes and pathways leading to depressive symptoms to be able to develop more effective prevention strategies and to target preventions effectively. Experiencing stressful life events, such as death of a loved one, divorce or personal illness, has been thought to be one of the causes leading to depression and evidence has been found for positive associations between occurrence of stressful life events and depressive symptoms (reviewed by Hammen, 2005). It has also been suggested that experiencing more stressful life events increases the risk for depression and there is some evidence of accumulation of stressful events leading to increases in depressive symptoms (Turner & Lloyd, 1995). Factors that can protect the individual from developing depression have also been studied and one of the widely studied protective factors is social support. Lack of social support has been connected with depression (Wade & Kendler, 2000b) but the results about the role of social support in buffering the adverse effects of stressful life events on increasing depressive symptoms have so far been inconsistent (Wade & Kendler, 2000a).

The aim of this study is to examine how the accumulation of stressful life events over the adult life course is associated with depressive symptoms in a nationally representative sample of Finnish adults and if social support moderates the association. This study is based on the longitudinal data from *The Cardiovascular Risk in Young Finns Study,* a prospective, population-based ongoing study examining risk factors contributing to cardiovascular diseases (Raitakari et al., 2008). The study cohort has been followed since year 1980, when the subjects were children, until midlife. A wide range of different medical and psychological factors have been measured multiple times during the study period. This study concentrates on self-reported data about stressful life events, depressive symptoms and social support

from follow-ups in 2001, 2007 and 2011/-12. This study adds to the previous literature by examining a population-based cohort sample with a longitudinal study design. This allows better examination of the possible relations since previous studies of accumulation of stressful life events and the association with well-being have mostly relied on cross-sectional designs (e.g. Mitchell, Tynes, Umaa-Taylor, & Williams, 2015; Turner & Lloyd, 1995). The implications of this study are to target prevention efforts more effectively on those potentially in higher risk for increased depressive symptoms because of accumulation of stressful life events, possibly combined with low social support.

1.1 Depressive disorders

Depression is one of the big public health issues worldwide (World Health Organization, 2017). It is approximated that over 300 million individuals (4.4% of the total world population) suffer from depressive disorders and the amount has been rising during the last decade (World Health Organization, 2017). Depressive disorders are estimated to be one of the leading causes of disability worldwide (World Health Organization, 2017). Also, in Finland, depressive disorders are a growing public health concern; the prevalence of depressive disorders has increased from 7.3% in 2000 to 9.6% in 2011 (Markkula et al., 2015). Depression is more common in women than men and is highly comorbid with other mental health and somatic conditions (Lönnqvist, Henriksson, Marttunen, & Partonen, 2014).

Depressive disorders can be divided into major depressive disorder, as defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; American Psychiatric Association, 2000) or depressive episode, as defined by the International Classification of Diseases 10 (ICD-10; World Health Organization, 2010) and dysthymia. Major depressive disorder is characterized by symptoms of depressed mood and loss of interest and enjoyment (Lönnqvist et al., 2014). Other symptoms include lack of energy, loss of appetite, sleeping problems, suicidal thoughts, feelings of worthlessness and hopelessness, memory and concentration problems, loss of sexual interest and weight loss or gain (Lönnqvist et al., 2014).

An individual may also experience symptoms of depression without meeting the clinical criteria for depression diagnosis. Many studies of depression use self-report scales such as Beck Depression Inventory (BDI; Beck, Steer, & Carbin, 1988) or Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977) which measure depressive symptomatology rather than a diagnosis of clinical depression. These scales include items measuring many of the cognitive, affective and somatic symptoms typical for clinical depression. Depressive symptoms have been observed to be over twice as common as clinical depression (Kessler et al., 2014). In the US between 20-25% of the population reported significant depressive symptoms (Wittayanukorn, Qian, & Hansen, 2014) and in a Korean community survey, depressive symptoms were observed in 11% and clinical depression in 3,7% of the general population sample (Oh et al., 2013). People with symptoms of depression have a significantly higher risk of developing major depressive disorder than those without depressive symptoms (Cuijpers & Smit, 2004). Depressive symptoms are related to increased psychological distress, poorer health conceptions and difficulties in everyday activities (Rucci et al., 2003), decreased quality of life (Chachamovich, Fleck, Laidlaw, & Power, 2008; Goldney, Fisher, Dal Grande, & Taylor, 2004), increased use of health care services (Goldney et al., 2004) and increased mortality (Cuijpers et al., 2013). Therefore, preventing subclinical depressive symptoms is important.

The etiology of depression is complex and multifactorial; biological, environmental and social risk factors all play a role (Kendler, Gardner, & Prescott, 2002; Kendler, Gardner, & Prescott, 2006). The many factors contributing to depression are largely interrelated making it a disorder that can develop by very different pathways in different individuals (Kendler et al., 2002; Kendler et al., 2006). This study will focus on the role of stressful life events in the etiology of depressive symptoms, controlling for several confounding variables.

1.2 Stressful life events and their associations with depression

Stressful life events are traditionally defined as discrete events with a beginning and end that disrupt the individual's usual activities and require readjustment (Holmes & Rahe, 1967). Examples of stressful life events include divorce, personal injury or illness and losing a loved one. In stress research acute life events have traditionally been considered as one type

of stressor, the other type being more chronic stressors such as poverty or living with a disability (reviewed by Hammen, 2005). This study concentrates on the acute stressful life events.

There is evidence of most episodes of major depression being preceded with stressful life events although most people experiencing stressful events do not develop depression (reviewed by Hammen, 2005). Both acute and chronic stressors have been associated with depression and more recent events seem to have stronger effects since the impact of the stressors tends to dissipate over time (reviewed by Tennant, 2002). Dissipation is especially seen in the effects of acute stressors, such as job loss or sudden illness, on the risk of major depression (Kendler, Karkowski, & Prescott, 1998). It also seems that dependent stressful life events, which are events possibly influenced by the individual's own behavior, are more strongly associated with outcomes of depression than are independent stressful life events with no such behavioral influences (Kendler et al., 2002; Kendler et al., 2006). Most of the studies of stressful life events and their relations to depression have been conducted in cross-sectional study designs and there is a lack of longitudinal studies, which make it possible to examine the relationships and their directions more clearly (reviewed by Hammen, 2005).

Life event research has mainly relied on two separate methods: interview-based methods and self-report checklists. Even though interview-based methods for collecting data about stressful life events are generally considered better, checklists are widely used in research of stressful life events. They are easier and cheaper to administer and require far less time than interview-based methods (Hammen, 2005). This is especially important with big samples since using self-report checklists is the only way to examine hundreds of people. The sample of this study consists of several hundreds of participants and data about the five stressful life events included in this study is therefore self-reported by the subjects. This study does not use a specific life events checklist, but stressful life events are reported by the subjects in the background information form and therefore resembles the checklist method.

The stressful life events included in this study are unemployment, divorce, death of a spouse, death of a child, and moving residence. These five stressful life events were selected

based on the data that was available. Data was obtained from the longitudinal nation-wide study *The Cardiovascular Risk in Young Finns Study* (Raitakari et al., 2008) which was initiated to examine the risk factors for cardiovascular health and these five stressful life events were included in the self-report questionnaires. The first four events have been studied widely and association between them and depressive symptoms have been found in longitudinal prospective studies (Hackett & Pickles, 2014; McKee-Ryan, Song, Wanberg, & Kinicki, 2005; Sasson & Umberson, 2013; Waite, Luo, & Lewin, 2009).

Studies have found *unemployment* to increase the risk of depression (Jefferis et al., 2011; McKee-Ryan et al., 2005). Job loss is found to be positively associated with depression as observed in a meta-analysis by McKee-Ryan et al. (2005). Similar results have been found about unemployment being related with depression in a longitudinal study exploiting a large cross-cultural sample of 3969 men and women, suggesting that the phenomenon is evident across cultures (Jefferis et al., 2011; McKee-Ryan et al., 2005).

Also *divorce* seems to lead to increased psychological distress (reviewed by Amato, 2000). This is supported by a longitudinal study by Waite et al. (2009) who studied a representative sample of 5232 US residents and observed that divorcing leads to increases in depressive symptoms. This increase in depressive symptoms is, however, not observed in those who remarry quickly after the divorce or those who are unhappily married before getting divorced (Waite et al., 2009).

Death of a spouse is considered one of the most stressful life events and has been associated with increased risk for depression in many studies (e.g. Sasson & Umberson, 2013; Van Grootheest, Beekman, Van Groenou, & Deeg, 1999). The results of a 14-year longitudinal study by Sasson & Umberson (2013) suggest that losing a spouse initially increases depressive symptoms but they diminish over time and in two years the symptoms usually tend to return back to the level before the loss. However, when losing a spouse early in life it seems that the depressive symptoms do not show a similar diminishing pattern over time (Sasson & Umberson, 2013; Van Grootheest et al., 1999).

Besides losing a spouse, *death of a child* can also be considered as one of the most stressful life events. Many studies have been conducted to find out if it in addition to normal grief

also relates to outcomes of depression. A population-based study in Sweden studied 449 parents who had lost their child 4-9 years earlier and compared their symptoms of depression and anxiety to a control group (Kreicbergs, Valdimarsdóttir, Onelöv, Henter, & Steineck, 2004). Parents who had lost a child had an increased risk for depression and anxiety 4-6 years after the loss, but the risk decreased to levels similar to the control group 7-9 years after the loss (Kreicbergs et al., 2004). Mothers who lose a child older than nine years seem to have higher levels of psychological distress over a longer time (Kreicbergs et al., 2004). Higher levels of depression following the loss of a child were also observed in another prospective population-based study which included 517 subjects who lost a child during the study period (Maccallum, Galatzer-Levy, & Bonanno, 2015).

Moving residence can also be considered a stressful life event since it requires the individual to adapt to the new surroundings possibly affecting mental well-being (Oishi, 2010). To my knowledge not many studies about moving residence and its relations to depressive symptoms have been conducted. The few studies that have assessed adult relocation and its effects on well-being have ended up with mixed results. A decrease in self-reported mental health after a local or a long-distance move was observed in an Australian study with 14 100 middle-aged women (Larson, Bell, & Young, 2004). Another study however observed positive outcomes in some areas of psychological well-being (e.g. self-acceptance, personal growth) and no differences in levels of depressive symptoms or personal relationships after moving residence (Kling, Ryff, & Essex, 1997).

Gender differences have been observed in experiencing stressful life events: women seem to report experiencing slightly more stressful life events than men and this seems to be true across different countries (Dalgard et al., 2006). Several studies have also found gender differences in the vulnerability to effects of stressful life event, suggesting that women are more vulnerable to adverse consequences of stressful life events (reviewed by Tennant, 2002).

1.3 Accumulation of stressful life events

Since studies indicate that stressful life events seem to act as risk factors for various negative mental health outcomes a question has been raised if experiencing a higher number of stressful life events poses an individual for an even higher risk for negative outcomes. Accumulation of risk factors has been studied especially in developmental research with several different risk factor domains, stressful life events being only one of the many. In developmental research cumulative risk has become the most common way to measure the accumulation of risk factors (Evans, Li, & Whipple, 2013). The approach has mainly been used in studies about risk factors during childhood but could also be a useful approach in studying accumulation of risk in adulthood, as in the current study.

1.3.1 Cumulative risk approach

In cumulative risk approach multiple risk factors are combined into a score to predict an outcome (Evans et al., 2013). Traditionally studies have analyzed how each risk factor independently affects well-being. Independent effects might not have been found for individual risk factors but when they occur cumulatively the effects on developmental outcomes appeared significant (Sameroff, Seifer, & McDonough, 2004). Studies with cumulative risk have shown that exposure to multiple risk factors during childhood, as opposed to one singular risk factor, poses a bigger risk for the child to develop adverse psychological outcomes (e.g. Elovainio et al., 2015; Evans et al., 2013).

Cumulative risk approach, although not without shortcomings, has become popular in research since it is statistically powerful (Evans et al., 2013). It weights the risk factors equally making no assumptions about their relative importance (Evans et al., 2013). In the Young Finns Study, the accumulation of childhood and adolescence risk factors on future health outcomes has been shown (Elovainio et al., 2015; Hakulinen et al., 2016; Pulkki-Råback et al., 2015). In the current study, the cumulative risk approach was further applied to study the accumulation of stressful life events in adulthood and its relation to mental health. Given that accumulation of risk in childhood strongly relates to future adverse outcomes (Atkinson et al., 2015; Elovainio et al., 2015; Hakulinen et al., 2016; Mitchell et al.,

2015; Pulkki-Råback et al., 2015; Turner & Lloyd, 1995; Turner & Lloyd, 2004), it can be reasonably hypothesized that cumulative risk in adulthood has similar negative impact on mental health. Accumulation of stressful life events can be combined into a cumulative score of stressful life events and the score is used in this study to analyze the effect on depressive symptoms, without taking into account the relative importance of the events included. This approach is similar to what has been used before when examining how the cumulative risk during childhood and adolescence relates to depressive symptoms in the Young Finns Study (Elovainio et al., 2015).

1.3.2 Relationships with mental health outcomes

In addition to the evidence of stressful life events contributing individually to increases in depressive symptoms and/or major depression there is also evidence that the accumulation of stressful life events contributes to worse mental health outcomes (Chou & Chi, 2001; Dalgard et al., 2006; Dulin & Passmore, 2010; Galea et al., 2008; Lloyd & Turner, 2003; Miloseva, Vukosavljevic-Gvozden, Richter, Milosev, & Niklewski, 2017; Seery, Holman, & Silver, 2010; Turner & Lloyd, 1995; Turner & Lloyd, 2004). A higher number of stressful life events during a person's lifetime have been associated with increases in depressive symptoms (Chou & Chi, 2001; Dalgard et al., 2006; Dulin & Passmore, 2010; Elovainio et al., 2015; Lloyd & Turner, 2003; Miloseva et al., 2017; Turner & Lloyd, 1995; Turner & Lloyd, 2004), substance abuse/dependency (Turner & Lloyd, 1995), posttraumatic stress (Galea et al., 2008; Lloyd & Turner, 2003) and anxiety (Dulin & Passmore, 2010; Turner & Lloyd, 2004).

It seems that especially the accumulation of stressful life events and adversity during an individual's childhood predict negative mental health outcomes (Turner & Lloyd, 1995). In a recent longitudinal study a sample of 284 five to twelve year-olds were followed for 20 years (Atkinson et al., 2015). Data about cumulative risk was collected two times during childhood and once more when the participants were 19-20 years old. Outcomes were measured when participants were 25-26 years old and included depression assessed with CES-D, in addition to other adverse outcomes such as dropping out of school, being arrested and smoking (Atkinson et al., 2015). Cumulative risk in their study did not include stressful life events but rather consisted of other known risk-factors such as parental socioeconomic status, number

of siblings and parents' marital situation (Atkinson et al., 2015). Results of the study support the notion that cumulative risk during childhood predicts both general and mental health related adverse outcomes, including depression (Atkinson et al., 2015). However, in a more recent cross-sectional study with a sample of 1126 older adults aged 65-94 it was noticed that for them remote events that had happened during their childhood and adolescence did not seem to play as strong role in the prediction of depression as did more recent experiences during young adulthood and middle age (Dulin & Passmore, 2010).

The pioneering study by Turner and Lloyd (1995) suggests that accumulation of lifetime stressful events in addition to accumulation of childhood stressful events is associated with both depressive symptoms and major depressive disorder. Also, a meta-analysis about associations between stressful life events and depression in older adults revealed similar results of higher numbers of stressful life events being related with higher amounts of depressive symptoms (Kraaij, Arensman, & Spinhoven, 2002). A large multinational study conducted in five European countries, including Finland, found almost linear associations between the number of stressful life events and depressive symptoms measured with Beck Depression Inventory (Dalgard et al., 2006).

To my knowledge only one study has examined the accumulation of adversity on depressive symptoms in an adult population using a longitudinal study design (Seery et al., 2010). Most of the studies so far examining the relations between accumulation of stressful life events and depressive symptoms and/or major depression have used cross-sectional designs and relied on retrospective recalls about events that happened during childhood and adolescence (Mitchell et al., 2015; Turner & Lloyd, 1995). The longitudinal study by Seery et al. (2010) used a nationally representative sample of 2398 US adults, 18-years and older, including an equal amount of subject of both genders. Data on cumulative adversity and psychological distress was collected five times during the follow-up period of three years. Cumulative adversity was measured retrospectively with a 37-item self-report check-list of stressful life events (Seery et al., 2010). Outcomes were measured by assessing psychological distress (depression, anxiety, somatization) during the previous week (Seery et al., 2010). The results implicated that higher numbers of stressful life events predicted worse mental health outcomes, including depression (Seery et al., 2010). The effect remained also when

several potential covariates such as gender, age, education, employment, and health history were controlled for (Seery et al., 2010).

1.4 Social support and the stress-buffering model

Social support can be defined as "The social resources that persons perceive to be available or that are actually provided to them by nonprofessionals in the context of both formal support groups and informal helping relationships." (Cohen, Underwood, & Gottlieb, 2000, p. 4). Social support has been divided into actual support, also called structural support, which is the quantified amount of support (e.g., how many times per month one meets friends or how many friends one has), and perceived support, which is the individual's subjective belief that support will be available if needed (Gottlieb & Bergen, 2010). The latter of these is used in this study. Perceived social support can be received from various sources such as family, friends, and coworker, and it can be divided into several types of functional support including emotional, instrumental, companionship, informational, and esteem support (Barrera, 1986, as reviewed in Gottlieb & Bergen, 2010).

Gender differences have also been observed regarding social support. In a multinational study it was observed that women report receiving more social support in connection with experiencing a stressful life event than men (Dalgard et al., 2006). Although men seem to possess extensive social networks their relationships are often more superficial compared to women (reviewed by Nurullah, 2012). Also, the nature of social support is often closer and more intensive in women than in men (reviewed by Nurullah, 2012).

Lack of social support has been associated with depressive symptoms and depression (reviewed by Paykel, 1994; Wade & Kendler, 2000). Smaller social networks and lower perceived social support have been found to be connected with higher amounts of depressive symptoms (Barnett & Gotlib, 1988). However, many studies of associations between social support and depression have been cross-sectional and relied on retrospective reports of social support in the past (reviewed by Paykel, 1994). Prospective designs where social support is measured and used predictively are seen as preferable in

order to avoid the possible biases associated with retrospective recalls, for example due to an individual's current distress (Paykel, 1994).

A stress-buffering model has been proposed by Cohen & Wills (1985) to represent the way in which social support affects depressive symptoms. Their stress-buffering model suggests that social support serves as a moderator in the presence of stressful life events and reduces their negative consequences on well-being (Cohen & Wills, 1985). The model has been studied widely but findings about the buffering effect have been inconsistent; some studies have found a moderating effect (e.g. Chou & Chi, 2001; Miloseva et al., 2017) while others have not (e.g. Burton, Stice, & Seeley, 2004; Stansfeld, Fuhrer, & Shipley, 1998; Wade & Kendler, 2000). In a study with a sample of 412 Macedonian adolescents aged 13-17 years a moderating effect of social support was observed, but only in the subclinical group and not in the control or the clinical groups (Miloseva et al., 2017). A buffering effect of social support was also observed when studying a sample of 411 Chinese older adults (Chou & Chi, 2001). Additionally, one study with a sample of 91 912 post-menopausal women in the US found a small but significant moderating effect in the opposite direction, so that in the presence of higher levels of social support the stressors had more negative effects on outcomes of depression (Uebelacker et al., 2013).

Furthermore, many previous studies about the buffering effect have assessed stressful life events only during the past year not considering the possible influence of accumulation of events during a longer time, or the entire life course (Burton et al., 2004; Chou & Chi, 2001; Wade & Kendler, 2000). This study is considering stressful life events during the whole adult life excluding childhood and adolescence and is therefore adding to the results of previous studies. For prevention, it would be important to find out whether social support buffers against the negative effects that stressful life events have on mental health.

1.5 Conservation of resources theory and the theoretical model of this study

The hypothesized model of the relationships between the main variables in this study (depressive symptoms, accumulation of stressful life events, social support, see Figure 1) is based on The Conservation of Resources (COR) theory. The theory suggests that stressful life

events consume resources (e.g. money, social relationships) and therefore have adverse effects on well-being (Hobfoll, 1989; Hobfoll, 2011). The theory states that people try to obtain, retain, protect and foster things that they value and threat to these resources leads to stress.

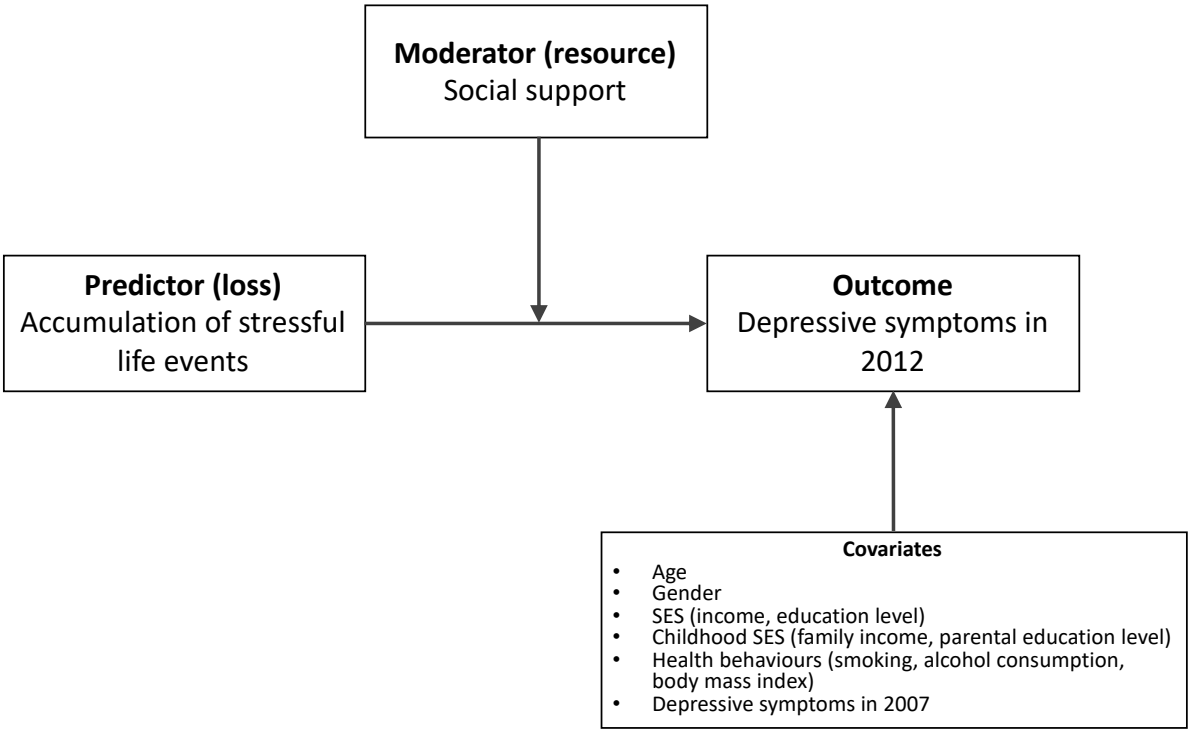

Figure 1. Hypothesized model of the relationships between accumulation of stressful life events and outcomes of depressive symptoms in this study based on Conservation of Resources theory by Hobfoll (2001).

The theory divides resources into four categories: objects (e.g. house), conditions (e.g. marriage), personal resources (e.g. traits) and energies (e.g. money) (Hobfoll, 2011). It also states that people must invest resources to protect themselves against resource loss (e.g. investing time in social relationships to not lose them), to recover from resource loss (e.g. investing money in a private doctor when getting ill) and to acquire more resources (e.g. investing money to buy a new house) (Hobfoll, 1989). Those with less resources are more vulnerable to resource loss, and on the other hand those with more resources are less vulnerable to resource loss (Hobfoll, 1989).

Losses consume resources affecting well-being and generating stress (Hobfoll, 1989). When experiencing a stressful life event, the individual tries to recover from the loss by investing resources e.g. turning to friends and family for social support (Hobfoll, 1989). Social support could therefore act as a protective resource against the negative impacts of stressful life events as the stress-buffering model suggests (Cohen & Wills, 1985). The general life situation as well as secondary gains or losses acquired from (un)successful adaptation contribute to the resources that are available for the individual to use at a certain time (Hobfoll, 1989). For example, when facing unemployment an individual with social support mainly from previous coworkers may fail to adapt to the situation and end up losing even more social support resources.

The Conservation of Resources theory does not imply directly how accumulation of stressful life events (in COR named losses) is related to depressive symptoms. However, the model suggests that both chronic (e.g. long-term unemployment) and acute (e.g. sudden death of a loved one) stressful events consume resources and increase stress (Hobfoll, 2011). Accumulation of stressful life events could therefore be hypothesized to have more impact on well-being because of increased stress and resource consumption when dealing with multiple stressful life events. Based on the Conservation of Resources theory and congruent to the stress-buffering model it could also be hypothesized that individuals with more social support benefit from this resource and could better protect themselves against developing depressive symptoms when faced with multiple stressful life events.

1.6 Research questions and hypothesis

To my knowledge no study so far has used longitudinal data to study the relations between accumulation of stressful life events during the adulthood and depressive symptoms in middle-aged adults. The longitudinal study by Seery et al. (2010) was conducted with an adult sample but the follow-up period was only three years. Although Seery et al. (2010) studied adults, their study covered stressful life events during entire life-course, including childhood traumas. This study is aiming to fill the gap in research by prospectively examining the relationship between accumulation of stressful life events only during adulthood and depressive symptoms in midlife in a longitudinal cohort study drawn from the Finnish

population. Many of the previous longitudinal studies of accumulation of stressful life events have been conducted in North America so this study will add to previous results also by examining the Finnish population, which is quite homogenous.

The research questions and hypothesis for this study:

1. Is accumulation of stressful life events over the adult life-course associated with depressive symptoms?

In line with the Conservation of Resources theory that stressful events consume resources and increase stress (Hobfoll, 2011), and based on the previous results that cumulative risk during childhood is related to depressive symptoms and clinical depression (Atkinson et al., 2015; Evans et al., 2013) and that stressful life events are predicting an increased risk for depressive symptoms and major depression (reviewed by Hammen, 2005; Tennant, 2002) the first hypothesis of this study is:

Hypothesis 1: A higher number of stressful life events during the adult life course is associated with a higher number of depressive symptoms in middle adulthood.

2. Does social support play a moderating role in the hypothesized association between accumulation of stressful life events and depressive symptoms?

Based on the COR theory, a higher level of social support is hypothesized to buffer the adverse effects of accumulation of stressful life events on depressive symptoms. For a buffering effect to occur, stressful life events should be associated with a lower number of depressive symptoms in people who experience high levels of social support as compared to those with low support. Therefore, the second hypothesis of the study is:

Hypothesis 2: A higher number of stressful life events during the adult life course is in middle adulthood associated with a lower number of depressive symptoms when higher levels of social support are experienced, and with a higher number of depressive symptoms when lower levels of social support are experienced.

2 METHODS

2.1 Participants and study design

The data for the study was obtained from the ongoing longitudinal nation-wide study *The Cardiovascular Risk in Young Finns Study* (Raitakari et al., 2008). The study was initiated to examine the risk factors for cardiovascular health but in addition to physical factors it includes also data about social and psychological factors. Participants were randomly sampled from five Finnish university cities with a medical school (Helsinki, Kuopio, Oulu, Tampere and Turku) and from rural areas nearby making the sample representative of the Finnish population. The participants from those areas were randomly selected in the study based on their social security number from the national register that covers the entire population of Finland. The first study phase was in 1980 including 3596 children and adolescents from six different age-groups: 3, 6, 9, 12, 15 and 18. Follow-up studies were conducted approximately every three years. The latest complete follow-up was conducted in 2011/-12 and it included 2063 subjects (57.37% of the original sample). This study used the follow-up studies between 2001 and 2011/-12.

This study included a sample of 753 subjects (20.94% of the original sample in 1980) who had complete data on all the measures included in this study (Figure 2). Life events were measured in 2001 and 2007, depressive symptoms in 2007 and 2012, and social support in 2001 and 2007. Subjects who did not have complete data on stressful life events in 2001 and 2007, depressive symptoms (BDI-II) in 2007 and 2012, social support in 2001 and 2007, and all covariates were excluded from further analysis. The final study sample consisted of 300 (39.84%) men and 453 (60.16%) women. They were 34-50 years old with a mean age of 43 years. Approximately half (49.00%) of the final sample had completed upper secondary school or a bachelor's degree. Around one third (30.15%) had completed only elementary school or vocational school, and one fifth (20.85%) had completed a master's degree or a higher university degree.

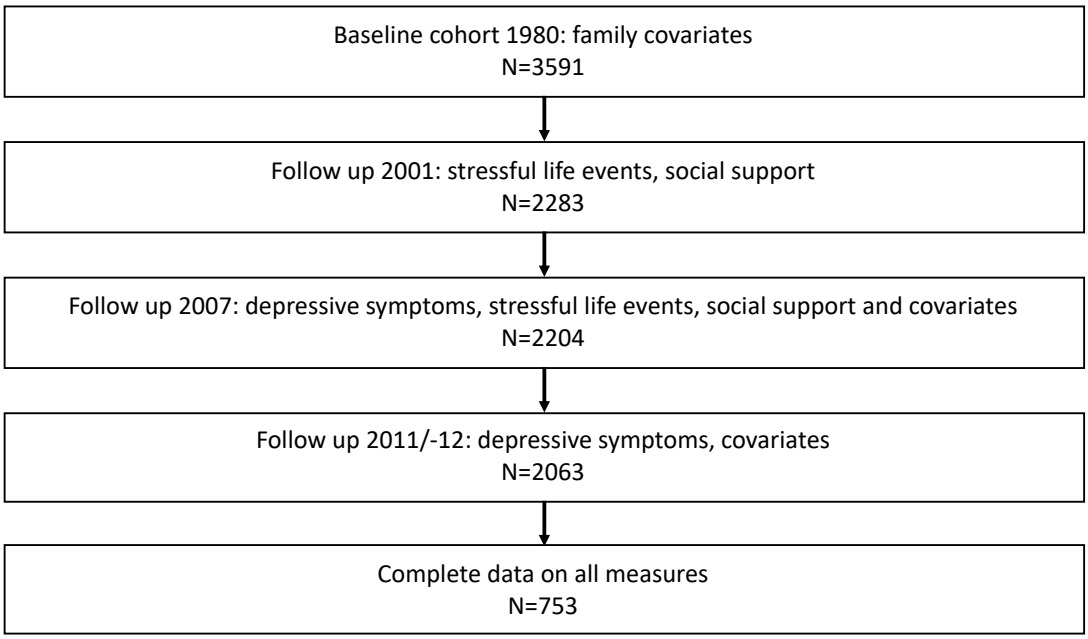

Figure 2. Study design, and recruitment and follow-up for current study sample from the Young Finns Study (1980-2012).

2.3 Measures

2.3.1 Depressive symptoms

Depressive symptoms were measured with Beck Depression Inventory II (BDI-II) which is a revised version of the original Beck Depression Inventory (Beck & Beck, 1972; Beck, Steer, & Brown, 1996). BDI-II is a self-report form with 21 multiple-choice statements (e.g. Item 1 "I do not feel sad." / "I feel sad much of the time." / "I am sad all the time." / "I am so sad or unhappy that I can't stand it.") and for each statement the respondent chooses the one that fits best. The points from each statement (0-3 points) are then summed and the total BDI-II score is a continuous variable between 0 and 63. A higher score indicates more depressive symptoms. In this sample the reliability (Cronbach's α) was .91 which is in line with reliabilities obtained in previous studies (Beck et al., 1996; Wang & Gorenstein, 2013). The distribution of BDI-II scores in the present sample was highly positively skewed as most subjects obtained low scores. The skewedness of the distribution was taken into account in the analysis with conducting a square root transformation for the variable. Analyses using the transformed BDI-II scores are reported in the tables and figures in Section 3. Analysis

were also repeated with using untransformed variables and the pattern of results remained consistent with the results with using transformed variables.

2.3.2 Stressful life events

Life events data was measured in 2001 and 2007 by self-reports. Participants reported if they had experienced unemployment, divorce, death of a spouse, death of a child, or if they had moved residence to another city/municipality (only asked in 2001). Unemployment was reported in 2001 as having occurred if the participant had experienced a period of unemployment anytime between years 1992-2001. In 2007 unemployment was reported to occur only if the participant was currently unemployed. For all the stressful life events, it was asked whether the event happened after year 1992 when the youngest age cohort was 15 years old. This made it possible to only study stressful life events in adulthood and how they relate to depressive symptoms excluding cumulative risk from childhood. Moving residence (N = 388) was the most commonly reported event followed by unemployment (N = 298), divorce (N = 99), death of a spouse (N = 14) or child (N = 8) (Appendix 1). Table 2 shows that in the sample there were 178 persons with two events, 35 persons with three events and two persons with four events. Because there were so few people with a large number of events, the three highest categories were combined into "2 or more events".

2.3.3 Social support

Social support was measured with Multidimensional Scale of Perceived Social Support (MSPSS) which measures the perceived social support from three sources: family, friends and a significant other (Zimet, Dahlem, Zimet, & Farley, 1988). MSPSS consists of twelve items that measure social support (e.g. Item 12 “I can talk about my problems with my friends.”). In the original MSPSS items are answered on a 7-point Likert scale but in *The Young Finns* study a 5-point Likert scale was used instead. The questions were answered based on how the subject experienced his/her situation at that moment (1 = totally disagree, 5 = totally agree). Scores for each of the three sources of social support are made up by summing the answers of four questions and range from 4 to 20. A total score for social support is obtained by summing the answers for all twelve questions and lies between 12

and 60. In this study the reliability (Cronbach's α) was .94 which is in line with previous results (Dahlem, Zimet, & Walker, 1991; Zimet et al., 1988). The distributions for social support scores were highly negatively skewed but categorizing the variable would have ended up with few subjects in the low and intermediate categories as opposed to the category of high social support. Since social support was used as an independent variable in the regression models it was therefore decided not to do any transformation for the variable. Social support score was used either from year 2001 or 2007 depending on which year the subject reported more stressful life events. This was done because social support scores closer to the stressful life events were thought to possibly moderate the association more strongly. If the participant reported an equal number of events on both years, the newer social support score from 2007 was used for the participant.

2.3.4 Confounding variables

Covariates were chosen based on the previous studies (Elovainio et al., 2007; Elovainio et al., 2015) and included both childhood and adulthood factors. The age of participants was controlled for to account for the possibility that older participants would have experienced more stressful life events. Childhood factors that were controlled for were socioeconomic status of childhood family, including parental education level and family income in 1980 when the study began. Adulthood factors that were controlled for included socioeconomic status of the participant which included education level and income, and health behaviors that consisted of smoking, alcohol consumption and body mass index. Education level was reported by the parents in 1980 and by the subjects in 2011 and classified in three categories; low (elementary school or vocational school), intermediate (upper secondary school or bachelor's degree) or high (master's degree or higher). Family income was reported by parents in 1980 and their own gross income by the subjects in 2011. Income in 1980 was reported by the parents in Finnish marks (FIM) and therefore transformed into the value in euros (€) using register data about cumulative inflation rates (Tilastokeskus, 2017). Reported incomes were reclassified in three categories: low (< 16 000 €), intermediate (16 001-35 000 €), high (> 35 000 €) based on the national register data about income levels (Tilastokeskus, 2018). Alcohol consumption was reported by the subjects in 2007 with categories 1 = two times per week or more, 2 = once a week, 3 = two to three times per

month, 4 = once a month, 5 = two to six times per year, 6 = less than six times per year or never. Smoking (yes/no) and body mass index (kg/m^2) were reported by the subjects in 2011.

2.4 Statistical analysis

The interaction between gender and stressful life events was non-significant and therefore the subsequent analyses were made for genders combined. Linear regression models were used to analyze the relationships between the number of stressful life events and levels of depressive symptoms. Four different regression models were computed: Model 1 was adjusted for age and gender, Model 2 was additionally adjusted for socioeconomic status (SES; including education, income, parental education and family income in 1980) and health behaviors (including body mass index, smoking and alcohol consumption). Model 3 was adjusted for the covariates in Model 2 and also with previous level of depressive symptoms in 2007. In Model 4 the interaction terms between stressful life events and social support on depressive symptoms were added in the model. All analyses were conducted with IBM SPSS Statistics 24.

3 Results

3.1 Sample characteristics and gender differences

The sample characteristics are reported in Table 1. Gender differences were analyzed with t-tests, chi square tests and Fisher's exact tests. Test statistics and their p-values are reported in Table 1.

Table 1

Sample characteristics and test statistics for gender differences

	Total		Women		Men			
Variable	*n*	mean +/- SE or %	*n*	mean +/- SE or %	*n*	mean +/- SE or %	test statistic	*p* value for gender difference
Age	753	42.98 +/- 0.18	453	42.97 +/- 0.23	300	42.99 +/- 0.29	χ^2 = 9.45	.95
Childhood risk factors (1980)								
Education, parents							χ^2 = 1.94	.38
Low	243	32.27 %	152	33.55 %	91	30.33 %		
Intermediate	309	41.04 %	188	41.50 %	121	40.33 %		
High	201	26.69 %	113	24.94 %	88	29.33 %		
Family income							χ^2 = 0.43	.81
Low	190	25.23 %	113	24.94 %	77	25.67 %		
Intermediate	397	52.72 %	243	53.64 %	154	51.33 %		
High	166	22.05 %	97	21.41 %	69	23.00 %		
Adulthood risk factors								
Education, participants							χ^2 = 11.14	.004
Low	227	30.15 %	116	25.61 %	111	37.00 %		
Intermediate	369	49.00 %	237	52.32 %	132	44.00 %		
High	157	20.85 %	100	22.08 %	57	19.00 %		
BMI kg/m2	753	26.07 +/- 0.17	453	25.83 +/- 0.23	300	26.44 +/- 0.23	t(721,9) = -1.86	.06
Smoking							χ^2 =5.11	.02
Yes	134	17.80 %	69	15.23 %	65	21.67 %		
No	619	82.21 %	384	84.77 %	235	78.33 %		
Alcohol consumption[a]	753	4.69 +/- 0.05	453	5.07 +/- 0.05	300	4.11 +/- 0.08	χ^2 = 97.82	<.001
Income							χ^2 = 62.34	<.001
Low	58	7.70 %	43	9.49 %	15	5.00 %		
Intermediate	370	49.14 %	267	58.94 %	103	34.33 %		
High	325	43.16 %	143	31.57 %	182	60.67 %		
Life events							Fisher's exact test	.012
0 events	200	26.56 %	109	24.06 %	91	30.33 %		
1 event	338	44.89 %	203	44.81 %	135	45.00 %		
≥ 2 events	215	28.55 %	141	31.13 %	74	24.67 %		
Depressive symptoms (BDI-II)								
In 2007	753	4.87 +/- 0.21	453	5.53 +/- 0.29	300	3.88 +/- 0.31	t(687,1) = 3.88	<.001
In 2012	753	4.29 +/- 0.21	453	4.67 +/- 0.27	300	3.73 +/- 0.33	t(751) = 2.22	.03
Social support	753	51.23 +/- 0.32	453	53.15 +/- 0.36	300	48.33 +/- 0.57	t(528,8) = 7.20	<.001

SE = standard error, BMI = body mass index, BDI-II = Beck depression inventory II

[a] measured on a nominal scale 1 = twice a week or more, 2 = once a week, 3 = 2-3 times per month, 4 = once a month, 5 = 2-6 times per year, 6 = less than twice a year or never

There was no difference between men and women in terms of age, parental education or family income in 1980. Women had higher level of depressive symptoms both in 2007 and in

2012 and they also reported slightly more stressful life events than men. Women also had higher levels of social support. Women had higher education level, but men had higher income. Men smoked more often, consumed more alcohol and their body mass index was higher.

Correlations between study variables are reported in Appendix 2. Contrary to what was expected, higher age was weakly ($r = -.17$, $p < .001$) associated with experiencing less stressful life events. Gender was moderately ($r = -.27$, $p < .001$) associated with social support: men had lower social support. Depressive symptoms in 2012 were moderately associated with depressive symptoms in 2007 ($r = .52$, $p < .001$).

3.2 Associations between stressful life events and depressive symptoms

A higher number of stressful life events (≥2) was associated with slightly more depressive symptoms (Table 2). This association remained after controlling for socioeconomic status and health behaviors but became non-significant after controlling for previous levels of depressive symptoms, suggesting that stressful life events did not predict change in depressive symptoms over time. The interactive effects between life events and social support were not significant ($F(2, 724) = 0.28$, $p = .76$), suggesting that the association between stressful life events and depressive symptoms was not moderated by the level of social support. Figure 3 depicts the association between stressful life events and depressive symptoms in participants with varying levels of social support.

Of the variables that were controlled for previous level of depressive symptoms in 2007 was associated with higher levels of depressive symptoms in 2012 ($\beta = 0.54$, $p < .001$). Higher body mass index ($\beta = 0.05$, $p = .09$) was marginally associated with higher scores of depressive symptoms and higher parental education level was also marginally associated with slightly higher levels of depressive symptoms ($\beta = 0.08$, $p = .06$). Other covariates were not associated with depressive symptoms.

Table 2

Unstandardized B and standardized β coefficients from linear regression models predicting depressive symptoms in 2012 (square root transformed) and the amount of stressful life events and social support and their interaction adjusted for covariates and depressive symptoms in 2007 (square root transformed)

	B	95% CI	β	*p*
Model 1				
Stressful life events				
0 events	0[a]	.	.	.
1 event	0.02	[-0.22, 0.26]	0.01	.85
≥ 2 events	0.33	[0.06, 0.59]	0.11	.02
Model 2				
Stressful life events				
0 events	0[a]	.	.	.
1 event	0.02	[-0.22, 0.26]	0.01	.88
≥ 2 events	0.29	[0.03, 0.56]	0.10	.03
Model 3				
Stressful life events				
0 events	0[a]	.	.	.
1 event	-0.01	[-0.21, 0.19]	0.00	.91
≥ 2 events	0.10	[-0.12, 0.32]	0.03	.37
Model 4				
Stressful life events				
0 events	0[a]	.	.	.
1 event	-0.04	[-0.31, 0.22]	-0.02	.76
≥ 2 events	0.18	[-0.11, 0.47]	0.06	.22
Social support	-0.02	[-0.05, 0.01]	-0.15	.11
0 events * social support	0[a]	.	.	.
1 event * social support	0.01	[-0.02, 0.05]	0.04	.56
≥ 2 events * social support	0.01	[-0.02, 0.05]	0.05	.47

0[a] = reference category, CI = confidence interval

Model 1: adjusted for gender and age

Model 2: adjusted for covariates in Model 1 + BMI, education, income, smoking, alcohol consumption, parental education, and parental income.

Model 3: adjusted for covariates in Model 2 + depressive symptoms in 2007.

Model 4: adjusted for covariates in Model 3 + interaction terms between stressful life events and social support are added.

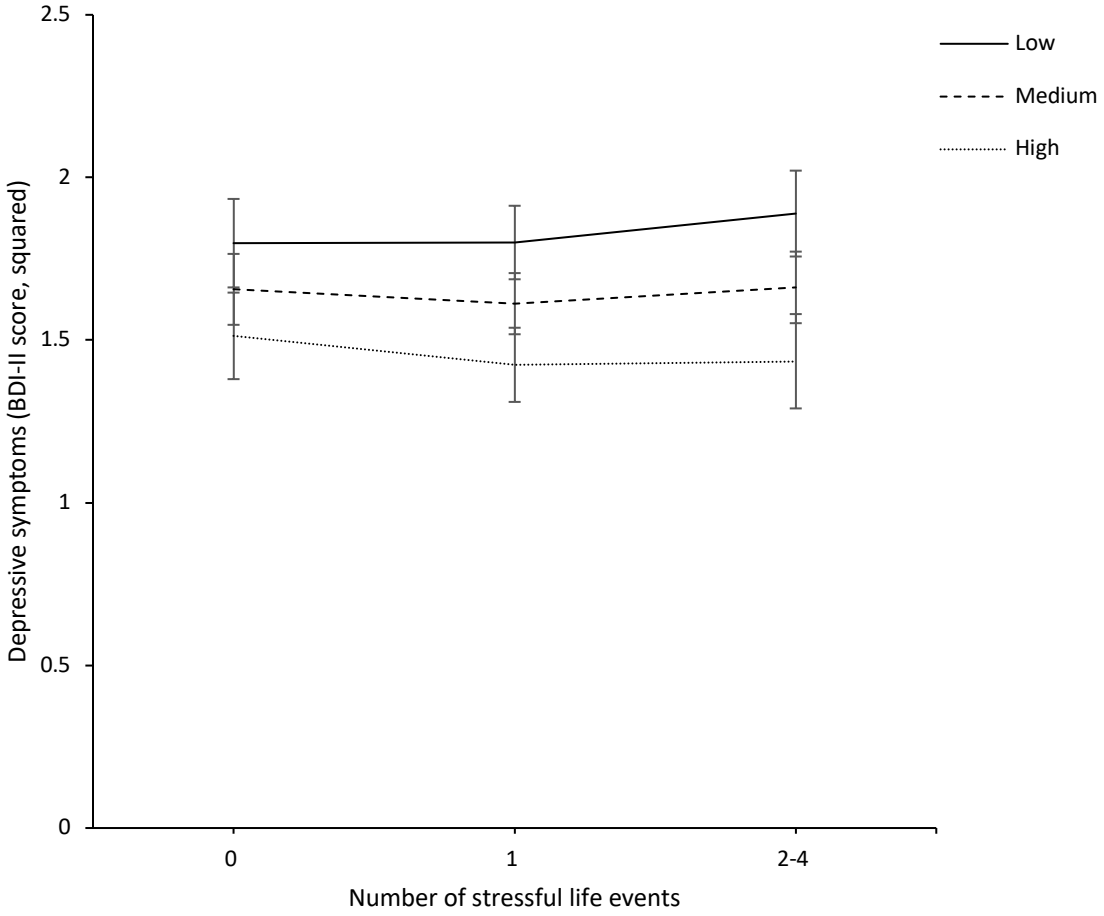

Figure 3. The association of stressful life events with depressive symptoms in participants with varying levels of social support (low, medium, high) based on mean +/- 1 standard deviation.

4 DISCUSSION

The aim of this study was to examine how accumulation of stressful life events over adulthood is associated with depressive symptoms in a nationally representative sample of Finnish adults. Another aim was to examine whether social support moderates the hypothesized association. The main finding was that people who had a higher number (≥2) of overall stressful life events had higher depressive symptoms than those with no events. People who had one stressful life event did not differ from those with no events. The positive relation between a higher number (≥2) of events with depressive symptoms was, however, independent of the presence of social support.

4.1 Associations between stressful life events and depressive symptoms

A higher number (≥2) of stressful life events during adulthood, in comparison with no events, was associated with higher levels of depressive symptoms when gender, age, socioeconomic status and health behaviors were controlled. One stressful event during adulthood, in comparison with no events, was however not associated with higher levels of depressive symptoms. The association between stressful life events and depressive symptoms became non-significant after controlling for previous levels of depressive symptoms. The first hypothesis of the study was therefore partly supported: experiencing more than one stressful life event seemed to be associated with increases in depressive symptoms. However, the results of this study did not confirm a dose-response association between accumulation of stressful life events and depressive symptoms, so that the more stressful life events one would experience the higher levels of depressive symptoms one would report. Also, stressful life events did not predict change in depressive symptoms over time.

The result that a higher number of stressful life events (≥2) were associated with experiencing more depressive symptoms is in line with previous studies that have observed stressful life events to predict depressive symptoms (e.g. Dulin & Passmore, 2010; Lloyd & Turner, 2003; Turner & Lloyd, 1995; Turner & Lloyd, 2004). Those studies had, however,

cross-sectional data and relied on retrospective recalls about events that happened during childhood and adolescence when studying the relationship between stressful life events and depressive symptoms. Thus, the current study provides new evidence based on longitudinal data and prospective reports of life events indicating the associations between accumulation of stressful life events and mental health. Studies using longitudinal prospective designs have found associations between distinct stressful life events such as divorce, unemployment and the death of a spouse or a child with increased depressive symptoms (Hackett & Pickles, 2014; McKee-Ryan et al., 2005; Sasson & Umberson, 2013; Waite et al., 2009). However, this study used the cumulative risk approach, and concentrated only on the accumulation of stressful life events, not on their relative importance, as opposed to the studies about distinct stressful life events.

This study differs from most previous studies about accumulation of stressful life events with concentrating only on events during adulthood. Previous studies have mainly studied the accumulation of stressful life events during childhood and/or the entire life span and few studies have concentrated only on the stressful life events during adulthood and whether those result in similar adverse health outcomes. Atkinson et al. (2015) who studied accumulation of cumulative risk during childhood and adolescence with a longitudinal design and Turner and Lloyd (1995) who studied accumulation of lifetime stressful life events with a cross-sectional design both found an association between the accumulation of events and negative mental-health outcomes similar to the results of this study. The only longitudinal study about accumulation of stressful life events in an adult sample was conducted by (Seery et al., 2010) with a follow-up period of three years, but unlike the current study their study included data about stressful life events during the entire life-course including also childhood traumas. The results of this study therefore add to the field by providing results about stressful life events that happen during adulthood also being associated with elevated symptoms of depression. However, it must be noted that besides family socioeconomic status other childhood adversity and childhood stressful life events were not controlled for in this study, and they have been suggested to be linked with the vulnerability for experiencing stressful life events in adulthood (reviewed by Mayo et al., 2017).

No differences in levels of depressive symptoms were observed between those who reported none, or those who reported only one of the stressful life events in this study. Some previous studies have found that adults with no experiences of stressful life events report more distress, including depression, than adults with a history of few stressful life events (Seery et al., 2010; Seery, Leo, Lupien, Kondrak, & Almonte, 2013). It has been hypothesized to be due to increased resilience acquired when having experienced previous stressful events (Seery et al., 2010; Seery et al., 2013). This was not tested in the current study, but since no differences were observed in levels of depressive symptoms at the lower range of stressful life events, it could possibly be that experiencing one stressful life event builds up resilience and therefore does not yet contribute to increases in depressive symptoms. Alternatively, the finding suggests a critical level of experiences that is needed for any health-effects to take place. Based on the results of the current study, this critical level could be hypothesized to be two stressful life events. However, as Holmes & Rahe (1967) observed in constructing their Social Readjustment Rating Scale, it might be that different types of stressful life events contribute to health-effects differently, so that for example death of a spouse is in their scale considered to have five times as strong effect on risk of illness than change of residence. Therefore, if there would be a critical level of experiences needed for health-effects to appear, this effect might also depend on the type of event that is experienced. This hypothesis could be tested in future studies by employing different methods than cumulative risk approach.

The results of the current study implicate that life events are associated with higher depressive symptoms but not with increasing levels of depressive symptoms over time. The direction of the association remains unknown and could therefore also be reverse, so that depressive symptoms lead the person to experience more stressful life events. It is possible that experiencing a higher level of depression makes the person behave in a way that he experiences more stressful life events (Hammen, 1991; Liu & Alloy, 2010; Phillips, Carroll, & Der, 2015). For example, a person with more depressive symptoms might not work as effectively and thus is possibly more likely to become unemployed.

It might be that the relationships between accumulation of stressful life events and depressive symptoms appear clearer in cross-sectional studies since people who report

depressive symptoms tend to recall their lives in a more negative light and therefore recall and report more negative life events (e.g. Gotlib & Joormann, 2010). In this study stressful life events were reported to have happened at least 5 and maximum of 20 years earlier than the outcome of depressive symptoms and therefore this "state-dependence"-bias might not be affecting the results of this study as much as it possibly affects results of cross-sectional studies. The results of this study therefore strengthen the previous findings that stressful life events are associated with depressive symptoms (e.g. Dalgard et al., 2006; Miloseva et al., 2017; Turner & Lloyd, 1995) and this seems to be true also over longer time periods.

4.2 Moderating effects of social support

Another aim of the study was to examine if social support could moderate the association between stressful life events and depressive symptoms. The results suggest that a higher number (≥2) of overall stressful life events is associated with depressive symptoms irrespective of the level of social support. Therefore, the second hypothesis of the study was not supported by the results, and this study does not give support to the stress-buffering model.

One possible explanation for the conflicting results is the lack of consistent methodology between studies. Previous studies examining the buffering effects of social support have used a wide array of different measures for social support. Perceived social support has been measured with a subset of questions from the Network of Relationships Inventory (Burton et al., 2004) and with the Multidimensional Scale of Perceived Social Support (Miloseva et al., 2017). Some studies have used scales such as Lubben Social Network Scale to measure aspects of social networks instead of perceived support (Chou & Chi, 2001). Others have used questionnaires such as Medical Outcomes Study Social Support Questionnaire (Uebelacker et al., 2013) or Social Interaction Scale (Wade & Kendler, 2000). The use of such a wide array of different measures in research about the buffering effects of social support makes it challenging to compare the contradicting results and may contribute to the inconsistency of findings.

One previous study (Miloseva et al., 2017) used the same questionnaire (MSPSS) that was used in the current study. Similar to the current study, Miloseva et al. (2017) also used depressive symptoms as a continuous outcome variable, and therefore results of this study can be compared to theirs in terms of the measurements. Results of this study differ from the findings by Miloseva et al. (2017) who found a moderating effect of perceived social support on the link between stressful life events and depressive symptoms. However, Miloseva et al. (2017) studied a sample of adolescents between the ages of 13 to 17 and used a cross-sectional study design, as opposed to the adult sample and longitudinal prospective design of this study.

The present study adds to the previous literature in the field by examining the buffering effects of social support when stressful life events are taken into account during the whole adulthood, but not childhood or adolescence. Since only stressful life events during adulthood were included, it is possible that the effects that stressful life events in childhood have on depressive symptoms are more strongly moderated by social support like Miloseva et al. (2017) observed in their study of an adolescent sample. Nonetheless, results of this study add to the previous findings by providing one more study where a buffering effect is not observed.

4.3 Methodological considerations

A weakness of this study compared to previous studies on the field is the relatively small number of stressful life events included. This study included five stressful life events, which is a smaller number than in most previous studies. For example, effects between accumulation of stressful life events and depressive symptoms have been found in an adult sample when using a 37-item self-report check-list of stressful life events (Seery et al., 2010) and in a sample of older adults with interviewing them about experiences of 10 different stressful life events during the past year (Chou & Chi, 2001). No subjects in this study had experienced all five of the stressful life events that were included and over 70% reported having experienced none or only one of the stressful life events. Also, the most commonly reported stressful life event in this study was moving residence, and the evidence of its

connections with depressive symptoms are to date lacking and mixed (Kling et al., 1997; Larson et al., 2004; Oishi, 2010).

Since few people had experienced more than two of the stressful life events in the Young Finns Study, it was necessary to combine two, three and four stressful life events into one category in this study. Therefore, it could not be examined whether the accumulation of stressful life events actually was associated with more depressive symptoms gradually so that the more stressful life events one had faced the more depressive symptoms one was experiencing. It is therefore possible that the number of stressful life events taken into consideration in the current study was not enough for the (linear) association between accumulation of stressful life events and depressive symptoms to properly show. It is also possible that during the study period the subjects had experienced other stressful life events that were not included in the current study (such as serious illnesses, death of a close friend/relative, serious accident etc.) but which are known to be associated with increases in depressive symptoms (e.g. Hackett & Pickles, 2014; Mash, Fullerton, Shear, & Ursano, 2014; Mitchell, A. J., Ferguson, Gill, Paul, & Symonds, 2013). Also, for some, moving residence might not have been experienced as a stressful life event but rather a pleasant change in life that increased their well-being (Kling et al., 1997).

A strength with the cumulative risk approach is that the stressful life events do not need to be weighted but all events are treated the same in the cumulative score. On the other hand, this could also be a limitation when the information about the risk intensity is lost. As the cumulative risk approach suggests, and similar to the current study, it might still be reasonable to include both severe events (e.g. death of a child, death of a spouse) and less severe events (e.g. moving residence) in future studies. However, in contrast to cumulative risk where the subjective ratings of risk intensity are not taken into consideration, in future studies participants could also be asked to rate how distressing they experienced the events they report. This information could then be used to weight the stressful life events and possibly draw clearer conclusions about the relationship that accumulation of stressful life events has with depressive symptoms as well as the moderating role of social support. This approach too has its limitations since judgements can be biased by mood and personal meaning (Hammen, 2005; Monroe, Slavich, & Georgiades, 2014). However, in the current

study, it might have been beneficial if it would have been possible to only include those subjects who experienced moving residence subjectively as a distressing experience since the relationship between moving residence and experiencing depressive symptoms is unclear. It is also possible that the effects are different in different populations and therefore it is encouraged to conduct future studies with other populations to find out if the associations between stressful life events and depressive symptoms are universal.

Despite the shortcomings discussed above, this study has many strengths. It provides results from a quite homogenous Finnish population adding to the previous studies of other populations worldwide. It is based on a nationally representative sample of the Finnish general population with a relatively large sample size for a longitudinal study (N = 753) which allows the results to be generalized to the whole population. The questionnaires that were used to measure depressive symptoms (BDI-II) and social support (MSPSS) are well known, have been studied widely, and used in previous research in the area (e.g. Miloseva et al., 2017). Since the data of this study is drawn from a well-known prospective research project, the measurements can be considered reasonably reliable. Also, this study adds to the field by providing results based on a design with a longer timeframe than most previous studies conducted on the field.

4.4 Future directions

In future studies, it is encouraged to carefully plan which stressful life events are included before starting data collection. Future longitudinal studies about accumulation of stressful life events would possibly benefit from a more carefully planned inclusion of stressful life events. Since the aim of this study was to examine the associations between accumulation of events and depressive symptoms, it could have been beneficial to include a bigger number of possible stressful life events in the cumulative risk score. Therefore, it is encouraged to include a higher number of potential stressful life events than what was included in this study to be able to draw clearer conclusions about the possible linear, or other, relationships between the accumulation of stressful life events and mental health outcomes. Since the more severe life events, such as deaths, are less common in the general population it is encouraged to include more events in general so that it would be possible to

study the relationships between accumulation of events and depressive symptoms without having to combine several categories, and to be able to use the number of stressful life events as a continuous variable.

4.5 Conclusions

The results of this study indicate that stressful life events during adulthood are associated with higher levels of depressive symptoms, but not with increasing levels of symptoms over time. The direction of the association thus remains unknown and it is possible that having higher baseline depressive symptoms makes the person behave in a way that he experiences more stressful life events (e.g. becomes unemployed, divorces). The results do not support the stress-buffering model, adding another negative result for it. The data of the study is drawn from a nationally representative prospective longitudinal research project and the results can therefore be considered reasonably reliable and generalizable. The results of the study implicate that directing prevention efforts to those individuals who have experienced several stressful life events could potentially diminish the elevation in depressive symptoms and therefore potentially prevent occurrences of full-blown depressive disorder.

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Appendix 1. Numbers of stressful life events

Numbers of stressful life events reported by the subjects in 2001 and 2007 combined.

	Total		Women		Men	
	N	% of sample	N	% of sample	N	% of sample
Moving	388	51.53 %	245	54.08 %	143	47.67 %
Unemployment	298	39.58 %	187	41.28 %	111	37.00 %
Divorce	99	13.15 %	65	14.35 %	34	11.33 %
Death of a spouse	14	1.86 %	11	2.43 %	3	1.00 %
Death of a child	8	1.06 %	5	1.10 %	3	1.00 %

Appendix 2. Correlation matrix

Pearson correlation coefficients and point-biseral correlations between study variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Age	—												
2. Gender[a]	.00	—											
3. Education level	-.13**	-.10**	—										
4. Income	.01	.27**	.32**	—									
5. Parental education level	-.28**	.05	.29**	.16**	—								
6. Family income in 1980	-.03	.01	.24**	.14**	.47**	—							
7. Body mass index (BMI)	.12**	.07	-.15**	-.04	-.12**	-.15**	—						
8. Alcohol consumption	.02	-.35*	.13**	-.06	-.01	-.02	-.12**	—					
9. Smoking[b]	.08*	-.08*	.18**	.06	.06	.10**	-.01	.27**	—				
10. Depressive symptoms in 2007	.00	-.14**	-.03	-.09*	-.04	-.08*	.16**	.00	-.05	—			
11. Depressive symptoms in 2012	.00	-.08*	-.07	-.09*	.01	-.06	.13**	.00	-.03	.52**	—		
12. Social support	-.06	-.27**	.13**	.04	.04	.07*	-.06	.06	.02	-.13**	-.19**	—	
13. Stressful life events	-.17**	-.09*	.06	-.07*	-.02	-.07	.04	-.02	-.01	.14**	.08*	.03	—

** p < .01, * p < .05

[a] Gender 0=women 1=men

[b] Smoking 0=yes, 1=no